TOWN OF BROCKVILLE,

PROVINCE OF ONTARIO.

REPORT OF BOARD OF SEWER COMMISSIONERS

WITH

REPORT OF ENGINEER

For 1889.

BOARD OF COMMISSIONERS :

THOS. WILKINSON, Esq., Chairman.

V. H. MOORE, M. D.

Lt.-Col. WILMOT H. COLE.

ENGINEER :

WILLIS CHIPMAN, B. A. Sc.

BROCKVILLE :

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TOWN OF BROCKVILLE.

Annual Report of the Board of Sewer Commissioners for 1889.

To the Mayor and Council of the Town of Brockville:—

Gentlemen,—In accordance with the By-law passed on 25th October, 1887, defining the duties and powers of the Drainage Commissioners, we have, during the year 1889, presented monthly reports on the progress of the work done and given orders on the Town Treasurer for the moneys expended.

These monthly reports, however, reach very few of the ratepayers, and we consider it a part of our duty to present an annual report, describing briefly, the work completed by the Board to date, and the cost of same, presented in such a way as to be readily understood by the ratepayers.

Legislation.

On 23rd March, 1889, an Act entitled, "An Act to enable the Town of Brockville to issue certain debentures for drainage purposes," was assented to by the Legislature of Ontario, by which the Corporation of the Town of Brockville was enabled to issue debentures to the amount of $100,000, payable in 40 years at the rate of 4% per annum, (payable half-yearly), for the construction of sewers.

On April 5th, the necessary By-law was passed by the Town Council, and in May these debentures were sold at what is considered a very high figure.

On the same date—April 5th—three other By-laws were passed by the Town Council, affecting sewers.

The first provided for the opening of a street 40 feet in width from Home street to Kincaid street, across property owned by Mr John M. Gill, Mr. J. E. Kincaid and Mr. J. G. Findlay, the centre line of which to coincide with the line of the main sewer.

The second By-law amended the By law passed on March 5th, 1888, and provided that for making connection with any sewer constructed out of the general funds, that the assessment shall be 90 cents per foot frontage, instead of 50 cents.

The third By-law amended the By-law passed on 11th October, 1887, limiting the amount to be paid by persons immediately benefited by the construction of a sewer to 90 cents per foot frontage. Any excess of cost over this amount to be borne by the corporation.

The principle of this last By-law is the correct one, and has enabled parts of the town to secure sewers and drainage where the cost was out of all proportion to the value of the properties benefitted, or to the ability of the persons to pay, but where sewers were absolutely necessary to drain higher levels as well as the abutting property.

In rocky towns, without a limit to the frontage tax, the local assessment act, as provided by statute, is not to be recommended, and we consider that this By-law limiting the frontage tax to 90 cents per foot a liberal and judicious enactment.

On May 9th, 1889, a fourth By-law was passed, amending the By-law of March 5th, 1888, providing that when a person drains his property into a sewer on a street upon which his property does not front, he shall pay for the privilege at the same rate per foot frontage as if his property fronted on said street, and provides for an equitable exemption in case a sewer is required on the street upon which the property actually fronts.

No changes have been made in the Rules and Regulations governing plumbing.

Work Completed.

We have completed the main sewer to a point near the Kingston Bridge, as instructed by your Council, which sewer is to be wholly paid for by the municipality. We have, at the request of your Street Committee, and according to your directions, constructed a storm sewer on Bennett street from Dyer street to King street to relieve this very wet portion of the town from surface water and periodical flooding and have constructed a storm sewer from North Augusta Road to Ford street, to take in the large surface flow that formerly flooded the street, sidewalks and private grounds adjoining every spring. These storm sewers, although paid for out of the amount raised by the sale of the drainage debentures, were not provided for in any estimates made on the cost of a sewerage system.

We have also constructed several sewers that have been built as local improvements, and completed those that were not completed in 1888.

As no outlet could be given to sewers if constructed on Church from Pearl to James ; on James from Wall to Garden ; and on Georgina from Pearl to the north end of said street, they were not commenced, although we have received your instruction to build them as soon as possible.

Your instructions to us to proceed with the construction of sewers on King from Mill to Tompkins Block, on Pine from Bethune to Garden and on King from Market Square to Garden, thence up Garden to Pine, were not received in time to insure that they could be completed in 1889 if commenced. We therefore, after consultation with your Sewer Committee and your Street Committee, decided to leave these works over until next year.

Recommendations.

We would recommend that the main sewer be continued from the point to which it is now built to the intersection of Pearl street West and Maple street early this coming season. From King street to George street, a street 50 feet in width has been given to the Corporation by Mrs. Gilmour, on condition that it be graded within a reasonable time. From

George street to Church street a street should also be opened of the same width as the street from King street to George street.

By the construction of this section of the main sewer all the sewage from the town east of the creek and south of Brock street will be intercepted and brought to one outfall. When the main sewer is continued to the intersection of Perth street and Brock street, a still greater portion will be served.

Some additional Rules and Regulations respecting plumbing and the construction of house sewers appear to be necessary. Those recommended by us are appended to the Engineer's report.

The report of the Chief Engineer herewith appended describes fully the work done during the past year, and gives a detailed statement of the cost of each sewer constructed or the part constructed and amounts expended for other purposes.

We would again respectfully urge upon your honorable body the necessity of providing water for supplying our flush tanks, as without it they are of little use.

Respectfully submitted,

T. WILKINSON,
W. H. COLE,
V. H. MOORE. } Board of Sewer Commissioners.

Brockville, Feb. 1st, 1890.

ENGINEERING STAFF, 1889.

WILLIS CHIPMAN, - - - - - CHIEF ENGINEER.

C. J. MARANI, 6th May to Oct 1st, - Assistant Engineer and Inspector of Plumbing.

C. H. ELLACOTT, 7th May to 25th August, - - - - Leveller.

J. H. CHEWETT, 24th April to 11th May, and 28th August to 21st December, Leveller. And after October 1st Inspector of Plumbing.

M. C. MCFARLANE, 1st October to 25th December, - - - Leveller.

S. A. LOGAN, 15th April to 31st December, -
H. W. HUTTON, 6th May to 8th " - -
H. MCKEE, 26th August to 9th " - } Inspectors of Pipe Laying and House Sewers.

REPORT OF THE ENGINEER

TO THE

Members of the Board of Sewer Commissioners.

GENTLEMEN,—The following report on the work completed to the end of the year 1889 is herewith submitted at your request:

In the report of 1888 a description is given of the system of sewers as adopted in the Town of Brockville, which it is not necessary to repeat except to state that we have the "Modified Separate System," with a main outfall designed to serve a population of over 15,000, and an unimportant outfall at another point to serve a population of about 4,000 people.

Main Sewer.

In January, 1889, before our last report was presented, the main sewer along the front of the town was completed to Home street, a total length of 3,000 feet from the shore end of the main outfall, which is 923 feet in length.

Early in the year profiles and plans were prepared for the extension of the main sewer from Home street to near Kingston bridge.

From Home street the sewer line crosses to the intersection of Kincaid and Jones streets; thence along Jones street to the centre of Mill street; thence up Mill street 91½ feet; thence westerly along an unnamed street to the centre of St. Paul street, opposite the Gas Works.

The route proposed for the main sewer from St. Paul street to the Kingston bridge in the preliminary reports and plans passed south of the buildings of the Brockville Gas Light Company; thence approximately parallel to the creek in a westerly direction. This route would have entailed considerable filling and would cross private property for the total distance, and experience has shown that the cost of a right of way for a public work generally exceeds the engineer's estimates. A second route was then proposed passing through the grounds of the Gas Company between the office and the brick building; thence in a direct line westerly to the Kingston bridge. By this route there would have been no filling required, but the right of way would probably have cost a little more than by the first route. It was finally decided to adopt a route still farther to the north and avoid as much as possible all private lands.

We therefore followed up the centre of St. Paul street until the residence of the Chief of Police was passed; thence turned and ran through the Corporation yard back of the Opera House and Central Fire

Station on a line parallel with the rear wall of the Opera House, to the lane leading to Mrs. Kilborn's property and bounding the Corporation yard towards the west; thence northerly along this lane to King street; thence along the northerly side of King street to the northerly side of the Kingston bridge.

Although this location gave a maximum cut of over 18 feet, the greater portion in rock, it is a much cheaper location than either the first or second proposed, and still cheaper than if we had run up St. Paul street to King street, thence along the northerly side of King as before, for the reason that at the intersection of St. Paul street and King street, the rock comes to the surface and the maximum cut at that point would have been over 22 feet.

The adopted route also provides a sewer along King street from the Opera House to Kingston bridge.

From Home street to the northerly manhole on Mill street the diameter of this main sewer is 18 inches, above this point 15 inches.

In April tenders were called for the construction of this work and the furnishing of materials.

The labor contract was awarded to H. Welch, and the materials to B D. Steacy. This sewer was completed early in November.

Sewers Built on Local Assessment Plan.

The King Street West sewer was completed from the point where work was suspended in 1888 to Mabel street during the summer, and the sewer on King Street East was constructed from East Avenue to Judge McDonald's property.

In November, 1888, reports and assessments were made for sewers on King street from Orchard street to Park street, and on Home and Chase streets from Jane street to George street. In April, 1889, reports and assessments were made for sewers on Bennett street from Dyer street to King street, and on Pearl Street West from Elm street to Perth street. In the latter part of May these four sewers were let, the labor to Contractor Harry Welch and the materials to B. D. Steacy.

On May 9th I submitted report and assessments for sewers on Market Square (west side) from Water to King, thence along King to Court House Avenue; on Broad street from Jane street to Flint street, and from Water street to King street; on St. Andrew street and Apple street from Jane street to King street.

On June 7th my report and assessment for a sewer on Mill and John streets from Jones street to Pearl street, and on Pearl street from John street to Ormond street, were presented.

On June 27th my reports were submitted for sewers on Market street from Pearl street to James street, and on Church street from John street to Wall street.

In July tenders were called for the construction of these eight sewers and the contract for labor was awarded to Armour and Cunningham, but the materials were obtained from several contractors, one furnishing all the pipes, another the bricks, another the cement, etc., etc. On all former contracts all the materials for one street were supplied by one contractor.

All of these sewers are now completed except Pearl Street East and Market Street North.

On September 23d I presented my report and assessment for a sewer on King street from Mill Street to Tompkins' Block, and on October 7th my report and assessments for sewers on Pine street from Bethune to Garden; on James street from Wall to Garden; on Georgina street from Pearl to the north end of the street and on Jessie street from Ann street to Grant street, thence along Grant street about 200 feet.

None of these sewers have been commenced except Jessie and Grant, which is nearly campleted.

Mill and John Street Sewer.

Of the sewers built upon the local improvement plan by petition, that on Mill and John street is the most important.

About the year 1873 a large drain was built from the river up the easterly side of Mill street to King street; thence up John street to Church street. This was continued in 1880 to a point a short distance above James street. The cost of the part below Church was about $4,000, and above Church street about $1,000.

This drain had an interior width of 18 to 24 inches and a depth of 3 feet. The side walls were of rubble-stone work about 18 inches thick, laid in *lime mortar*, the bottom, when not in rock, was flagged, and the top covered with cedar timbers about eight inches thick.

The grade of this drain on John street appears to have been about 1 foot in 150 feet. From King street to Church street this drain followed approximately the centre line of John street, but at Church street it was diverted in a curved line to the west side of the street, returning to the east side at James street. This drain ends a short distance above James street.

From the main sewer to King street the sewer constructed followed approximately the centre line of the street, leaving the large drain to the east. Above King street it was at first proposed to follow the old drain as far as possible and take it up, deepen it, lay our new sewer at the proper grade and then rebuild the old sewer.

As the exterior width of this old drain was found to be about five feet, it was seen that it would require a trench at least six feet wide, or about double what is ordinarily required, and that where there was no rock it would be much cheaper to keep to one side of the old drain. In rock, although by following the old excavation the cost of rock work would be much less, it would be necessary to remove all of the materials in the old drain and rebuild it afterward on a shrinking foundation unless an expensive concrete bottom were put in.

It was finally decided to avoid the old drain wherever possible, by doing which repairs or connections can in future be made to either without affecting the other, and during construction danger from flooding could be guarded against without retarding the progress of the work.

The new sewer crosses the old drain about 80 feet north of the northerly limit of King street, thence along the east side of the old drain

parallel to it and about 6 feet apart centre to centre, to Church street. At James street the old drain is again crossed immediately south of the manhole.

The depth of the sewer is sufficient to permit house connections to be made with it in most cases by passing under the old drain.

This old drain is of sufficient size to carry a much larger amount of storm water than now finds its way into it, some of the street gratings at George, Church and James being blocked up completely.

John street sewer has always been considered as one of the sewers in which many difficulties would be encountered. It has been a difficult, unpleasant and troublesome piece of work, but has been completed with great care at a moderate cost.

Storm Sewers.

On April 12th I made a special report on a sewer for Bennett street, recommending that a 12 inch pipe be laid in the centre of the street, which is only 20 feet wide, from a point near Dyer street to the northerly side of King street; thence westerly along King street until it could be given an outlet into the street ditch near Easton's blacksmith shop, at which point a large culvert crosses King street from north to south.

This pipe was designed to carry the small creek that flows southerly through that part of the town from Pearl street near North Augusta road to Bennett street at Dyer street. Owing to the fact that the rock on this street approached within two or three feet of the surface the cellars under the houses became flooded after every heavy rain or from water from this creek. Several of the houses were tenantless during the past year for this reason, as it was found hazardous to health to reside there.

After the matter had been under consideration by the street committee and the sewer committee of the Town Council, instructions were given to go on with the work, the property to be assessed as provided by By-law, at 90 cents per foot frontage, and two pipes to be laid side by side; a 12 inch main for storm water and a 9 inch main for sewage only. This work was completed in October by Contractor Harry Welch.

Early in October, at the request of the street committee, plans and profiles were made for the construction of a storm sewer from Ford street to Bennett street. After it was let we were instructed to continue this sewer to North Augusta Road. This work was completed by Contractor Harry Welch early in December last.

A storm sewer was built on Broad street in 1888, from Jane street to the River.

Materials.

During the year we have used sewer pipes of three different manufactures—Scotch; Hamilton, Ontario; and St. John's P. Q.

Before August it was found necessary to reject from 25 to 50 per cent. of the sewer pipes on delivery here. This severe but necessary culling gave great dissatisfaction to the contractors for materials, and an arrangement was made by which inspecting and culling should in future be done at the point where pipes were loaded on the cars.

As some delay might be caused by not having materials on hand to commence work early next spring, it was decided to purchase a few car

loads of pipes as a reserve, at the close of the season, and to store them over the winter.

The agricultural drain tile used this season was of much better quality than that used formerly.

The Portland cement used was carefully tested by subjecting bricquettes of one square inch cross-section to tensile strain after 24 hours immersion in water,. Several brands of cement have been tested, but we have found only one brand that has given us uniformly good results. The standard of strength required here has been high, 125 pounds per square inch, but in wet trenches, and nearly all of the Brockville trenches are wet, a quick setting cement is the only cement that is of any use.

Brockville brick have been used throughout.

Construction.

To date, the contractors for labor on the different sewers have employed local labor entirely and local contractors have secured all the contracts for labor given.

No lives have been lost from injuries received while on the works, notwithstanding that blasting operations have been carried on almost daily from April to December in each year.

Accidents and miraculous escapes have occurred, and these should be a warning to the contractors to take every precaution to prevent their repetition.

It was my privilege during the year to visit many cities and towns in Canada and in the United States, and I can safely say that in no place is greater care taken to secure good materials or to ensure good workmanship than in Brockville.

Records and Plans.

"Records have been kept of the work done, showing the grade and depth of every sewer, the location of all manholes, flush tanks, lampholes, etc., the positions of all gas mains, water mains, drains, and the service pipes for gas and water met with in the trenches. Also the position and extent of all rock excavated."

"The profiles and plans upon which tenders were called have been converted into *final* plans by plotting thereon all Y junctions, gas and water pipes, drains, rock excavated, etc., but it would be better if proper final plans were prepared, the sheets to be uniform in size and bound into volumes after completion. In a few years the present profile plans will be worn out from frequent reference."

The above is quoted from the report of last year. The sooner these final records are prepared the easier it can be done and the more accurate they will be.

New Plumbing.

During the year plumbing licenses were granted as follows:

No. 3, J. D. Barsalow, 23d January, 1889.

No. 4, Steben & McBrearty, 26th January, 1889.

No. 5, Elswood Smart, 21st June, 1889.

No. 6, M. McBrearty, 1st October, 1889.

No. 7, B. F. Steben, 4th December, 1889.

I am much pleased to be able to report that the Rules and Regulations are now being fairly well observed. Much less wood work is now being placed around fixtures and pipes than formerly.

In 1888 only 16 plumbing applications were filed, while in 1889 there were filed 64 applications, a very few of these being for alterations in old work.

Each application is examined when it is filed. If work is found to be badly designed or faulty in any way it is returned to the plumber for corrections or alterations. When the soil pipe is in place from the basement to the point where the closet or highest fixture is to be connected, the water test is applied and the pipes and joints are then carefully examined for leaks, sandholes, etc. As extra heavy soil pipes under this test very often show leaks, there can be little doubt that few of the soil pipes on the market are tested at the foundries where made.

After the vent pipes, fixtures, etc. are in place the work is then examined again and defective workmanship, if any, is pointed out. Each filed plumbing application means from two to five inspections, and it is safe to say that the average cost of inspecting and entering up plans and notes for each piece of work inspected is about $3.00.

Good plumbing can only be secured by constant and efficient supervision. This supervision costs money, but without it our sewer system would soon be pronounced a failure. We have at all times recommended the importance of carefully supervising this part of our sewer system, and the discoveries made in inspecting old plumbing work during the last two years shows the necessity of such supervision.

Old Plumbing.

In the inspection of old plumbing work we have found not only traps unvented, soil pipes sealed at upper fixtures and not continued through roof, light pipes, worthless fixtures, leaky pipes and joints, but many more serious defects. In several buildings we have found the 2-inch seat vent of closet connected directly with soil pipe, thus allowing sewer air to pass in building through a two inch opening. We have found soil pipes and vent pipes turned into chimneys with openings into living rooms. We have found sewer pipe (not of iron) under cellar floor broken in several instances and at each discharge of fixtures above a portion of sewage would find its way under cellar flooring.

In one building we found that a 2-inch trap vent in a closet bowl had been left open by the plumber who put in the work. He evidently did not know the purpose for which the opening was left. In a public building we found that where the main soil pipe and two waste pipes entered the drain along the cellar bottom, that there was an opening of several square inches at points of connection, through which sewage occasionally, and foul air at all times could escape.

The average plumbing work done before our Rules and Regulations were in force for an ordinary dwelling may be described as follows:

In cellar, 6 inch sewer pipe laid with cement joints, or with blue clay. Soil pipe of iron (light weight, 9 pounds to the foot) continued up to second story, there sealed with cement. Sink of cast iron with unvented

trap boxed in with woodwork. By turning on water taps when grating over outlet was closed, water would run over sides of sink and saturate flooring and wainscoating under sink, thus causing a bad smell at all times, a veritable "stink-box."

On the second flat would be found a bath tub, wash bowl and water closet, all tightly enclosed with woodwork, frequently ornamental in appearance. The closet would be a pan closet connected directly with water main, a plunger or valve closet connected in the same way, or a "national" closet with overhead cistern. The wash bowl outlet would generally be so small that considerable dirty water would flow over the sides into the "stink-box" below.

The bath tub being less frequently used and being so large would seldom be filled to overflowing, and then the water would probably be much cleaner than that used in either the sink or wash bowl. When the average bath tub is used once the wash bowl is probably used twenty times and the water closet probably seven times. In no case would any of the traps be found vented, with the exception that occasionally a galvanized iron pipe would be carried from the trap vent of the closet through the roof and capped with a cowl or run into a chimney. In a few cases the trap vent and bowl vent would be united and carried into a chimney or out through the roof. These means of ventilation are worse than none at all, as in case of 2 inch pipe through the roof, it would become closed in winter by frost, and sewer air would escape through joints, which are generally found to be leaky in galvanized iron pipes; and in the case of ventilating into chimney or where vent pipes were united, sewer air had a free entry into building.

The above sanitary defects are however completely overshadowed by the odors and effluvia arising from the polished walnut "stink-box" enclosing the water closet. This fixture is used in almost all cases as a urinal and a slop-hopper as well as a closet, and frequently the slops, etc. are thrown in with so much violence or force as to throw some of the contents out of the bowl of the closet and down the outside of the bowl to mix with the dust, cobwebs, etc. that collect in such places. Part however of the slops, and especially a part of the urine, is generally absorbed by the woodwork which forms the seat of the closet.

The faults above described are so serious and so common that it is not surprising that sanitarians with good intentions, but unacquainted with the details of modern plumbing, should but faintly praise one of the greatest blessings and comforts of modern civilization.

I have opened out and examined dozens of these closets and seldom have I found one perfectly clean, the great majority being very offensive, so much so that the tenants, although habituated to the odor, were convinced that all water closets were necessarily odorous.

Keeping a water closet clean on the inside is not enough, it must be kept perfectly clean on the outside as well. When a fixture is allowed to become dirty it soon becomes filthy, then offensive, then dangerous. With perfect cleanliness modern plumbing fixtures, minus "stink-boxes," will cause no offensive odors in a building. To ensure cleanliness light and air are needed. Place a closet in a dark cellar or basement and it will as-

surely become offensive. This statement is not capable of a theoretical proof, but in practise it is found to be universally true.

Plumbing in Small Buildings.

Many people are prejudiced against placing a water closet in the house, presuming that foul odors and danger to health will follow shortly after its introduction. If these people would critically examine a few of the premises plumbed during the year 1889 their prejudices would certainly disappear.

Others say that plumbing fixtures cost too much money, that they cannot afford the expense. The cost of putting in a soil pipe from front cellar wall through building to a point above the roof, with the house sewer to connect with the street sewer, comprises about half of the expense of putting in the necessary plumbing fixtures, with proper traps, wastes and ventilation pipes. The only necessary fixtures are a water closet a kitchen sink.

A careful estimate shows that in an average house built 10 feet back from the street line, two stories high, the cost of putting in a soil pipe and house sewer will be about $60.00 ; a kitchen sink with waste, trap and vent, $15.00 ; water closet, tank, vent pipes etc., $40.00 ; carpenter work, joiner work, plastering, painting, etc., $10 ; total, $125.00. A bath tub and wash bowl, although desirable, are not necessary ; they can be added at an additional cost of about $40.00.

In any building worth $1,000 an expenditure of $125 for putting in plumbing fixtures is not extravagant, when we consider the dangers to health avoided in winter by the use of water closets within a building, instead of outside privies, and in summer the improved sanitary condition of the premises, especially of the back yard and the rooms overlooking it.

The floor space required in a building for a water closet compartment need not exceed 3 feet by 4 feet, but that compartment should be well lighted and ventilated.

In all new buildings that will be erected on streets on which a sewer is constructed or to be constructed, plumbing fixtures will no doubt be put in, but in old buildings with no plumbing fixtures except a kitchen sink, it will be some years before the majority even will have water closets and other fixtures. In many of these houses, however, where the owner or tenant complains that the cost of plumbing is altogether too much and more than he can afford, will be found pianos and other articles of comfort and luxury of sufficient value to put in several sets of necessary plumbing fixtures.

There may be some few buildings where space cannot well be spared for a water closet compartment, but it is better to sacrifice a part of a bed room or a hall than to be subjected to the discomforts and dangers of using outside privies.

Sewer Connections.

One hundred and six permits have been granted for making connection with our sewer system, making a total of 134 to Dec. 31st, 1889. A few of these connections have been made for cellar drainage only, and several permits have been for double houses. In case the building to be connected has plumbing fixtures that were put in before the Rules and Regulations were in force, an examination is made and defects in plumb-

ing, if any, are pointed out to the owner or tenant. If the defects are of such a serious nature that in the consideration of the Engineer the health of the occupants is endangered thereby, it is reported to the Medical Health Officer. The Engineer and Medical Health Officer then prescribe what alterations are necessary to place the premises in a proper sanitary condition. With one or two exceptions the owners gladly made the necessary changes that were recommended.

The cost of superintending sewer connections probably averages $2.00 each.

Cellar Drainage.

On many streets in Brockville cellar drainage is an important matter, and on one or two streets sewers have been petitioned for solely for the purpose that cellars might be drained.

Alongside every sewer is laid an agricultural drain tile not connected in any way with the sewer proper. As previous to the commencement of our sewer works cellars were drained by box drains averaging 6 inches square or tile drains from 4 inches to 9 inches in diameter, the popular opinion of the new system of draining through tiles two inches in diameter was not favorable.

We did not at the time they were laid expect that every line of agricultural drain tile would work satisfactorily and drain all cellars, for the reason that many cellars and basements allow water to enter them in large quantities in times of thaws and heavy rains, and a small drain tile cannot carry it away as rapidly as it enters. This can be remedied only by adopting such means as will prevent rain water from entering the cellars.

In 1887 and 1888 the sizes of agricultural drain tile used were fully equal to those used in any other places, but on Thomas and Ann streets it was found that in times of rain the tile ran full and the water forced an entrance into the manhole at the foot of Ann street. On Water street east of the tunnel the drain tile is 6 inches in diameter in the lower portion, then 5 inches. The grade of this tile being only about 1 in 600, I always doubted whether it would be a success, as if sand or earth could find entrance into it either at joints, through a defective pipe, or if brought into it from tributary drains it would be deposited in this main tile. It was hoped, however, that by flushing it occasionally until the earth in trench became solidified, that it might be kept in working order. In 1888 it was found obstructed near the outlet and was cleaned out. In April, 1889, it was again flushed and again in the fall. A very large flow of sub-soil water comes down Orchard street drain tile and falls vertically into the main 6 inch tile at the Orchard street manhole on Water street. This appears to cause slack water above this point in the 6 inch main tile, as between Park street and Orchard street this drain tile is now blocked. From Orchard street to the outlet it is working well. At Bethune street the drain tiles have a free outlet at the river, a good stream is flowing there continually.

Outlets have been given the drain tiles at Broad street into the storm water sewer, at Mill street into the old drain, and at the Kingston bridge into the creek.

A large flow of sub-soil water flows down Home and Chase street drain tile and in time of heavy rain it was found that a cellar connected

with the drain tile on Jane street became flooded by water running from the tile back into the cellar. This has been remedied by giving the cellar drain an independent outlet. On King street West the drain tile became filled with quicksand and flooded a cellar. This was opened up and cleaned out and has worked satisfactorily since. In another instance the cellar drain tile was improperly laid and became closed, but this was no fault of the sewer system.

It appears from the experience gained during the last two years here, that where an agricultural drain tile laid at a steep grade connects with one laid at a very flat grade the latter may become blocked above the junction. In future it may be advisable in such cases where the steep tributary tile cannot be given a free outlet into a storm water drain, the river or a natural water course, to allow it to empty into the manhole through a trap. By adopting this method I am of opinion that the drain tile along Jane street and Jones street, and on other streets where tributary streets are at a steep grade, will cause no trouble.

Maintenance.

In May, 1889, the sewers completed were flushed, and a "pill" of about two inches less diameter than the sewer flushed was passed through each sewer. The drain tile along the main sewer from Home street to the outlet was also flushed. Obstructions that had been allowed to enter the sewer during construction were removed. In three cases it became necessary to open up the sewer.

In May the large sewer built a few years ago by the owner of the adjoining property on East Avenue, which discharged into an open ditch at King street, was connected with the King Street East sewer, thus putting an end to an intolerable nuisance at that point.

In August the Brockville Water Company gave the board notice to cease using water in our flush tanks and refused to connect any new tanks with their mains. Since this time the sewers have been flushed occasionally by the fire department under the direction of one of our inspectors.

In December, 1889, all of the sewers were again flushed.

The main outfall pipe was flushed several times during the year by closing the iron valve and allowing the sewage to accumulate until a head of four or five feet was gained, then opening it as rapidly as possible.

No sewer can be kept clean without flushing; it is to be hoped, therefore, that arrangements can be made with the Brockville Water Company by which the different flush tanks constructed during the year may be connected with the water works mains and be supplied with water.

To provide a means of easily flushing the main sewer below the opera house, it would be advisable to connect the bottom of the large water tank under the central fire station with the manhole in the lane to the south of the station and provide it with a valve so that the full contents of the tank could be discharged into the sewer at this point.

Cost.

Schedule A shows the amount expended on each sewer to the end of the year, allocated in a convenient way. It is impossible that such allocations can be more than approximately exact, but any error is probably less than one per cent.

From this schedule we find that the expenditure out of the general funds has been as follows:

General	$ 1,093.26	
Plumbing	556.77	
Maintenance	379.61	
		$ 2,029.64
Main outfall and Main Sewer, sections 1, 2, 3 and 4	$23,523.42	
Thomas and Ann	3,335.87	
		$26,859.29
Storm Sewer—Broad	$ 349.06	
Bennett	600.00	
King Street East	2,540.06	
		$ 3,489.12
Grand Total		$32,378.05
Value of reserve materials in stock		2,101.67
Sewers constructed as local improvements		36,334.46
		$70,815.18

From the above it is seen that the amount expended on sewers constructed on local improvement is but little more than half the total expenditure.

The reserve materials in stock are for use on sewers under construction and section 4 of main sewer.

Schedule B deals entirely with sewers constructed as local improvements. The frontages and costs are only approximate, but are sufficiently accurate to show that about one fourth of the total expenditure for sewers constructed as local improvements will be paid by the corporation at large and three fourths by the property owners. This appears to be a reasonably judicious division of the cost.

Schedule C gives size and length of each sewer and rock excavated from each completed sewer or that part now completed; also the contractor by whom constructed.

Schedule D is an estimate of the amount that will be required to complete the sewers under construction and those now petitioned for. If these sewers only are constructed next year the total expenditure will amount to about $87,000, of which sum four or five thousand dollars should not be charged to sewer works, but to street account, as it was not contemplated when our works were designed or when the special act was passed by the Legislature to permit the Corporation to issue debentures for sewerage purposes that any of the money so raised would be expended for constructing storm sewers.

Schedule E gives statement of reserve materials in stock.

Respectfully submitted,

WILLIS CHIPMAN, C. E.

Brockville, 1st February, 1890.

SCHEDULE A.

Expenditure from November 1st, 1887, to December 30, 1889.

SEWER.	Labor.	Materials.	Sundries.	Enginer'g	Inspecting	Total.
General	$ 5 00	$ 185 13	$ 370 63	$ 473 00	$ 59 50	$ 1,093 26
Plumbing			73 67	231 60	251 50	556 77
Maintenance	104 16	18 85	55 95	58 25	142 40	379 61
Main outfall	4,430 40	2,448 02	247 37	145 00	78 00	7,348 79
Main sew'r sec. No. 1	4,051 53	1,449 37	120 59	193 50	225 00	6,039 99
Main sew'r sec. No. 2	2,302 39	1,428 62	23 50	59 00	97 50	3,911 01
*M'n sew'r sec. No. 3	3,142 08	2,339 73	368 04	170 75	104 00	6,124 60
‡M'n sew'r sec. No. 4	43 63	34 90		20 50		99 03
Thomas and Ann	2,359 88	651 34	50 90	145 75	128 00	3,335 87
Br'd st. storm sewer	150 75	165 16	2 65	12 50	18 00	349 06
K'g East storm "	1,155 81	1,215 72	43 78	76 25	48 50	2,540 06
Market	1,289 53	484 04	29 56	78 50	51 00	1,932 63
Orchard	1,253 43	461 16	19 20	70 00	43 00	1,846 79
Ormond and Pine	1,055 45	361 33	12 10	71 00	60 00	1,559 88
Bethune & branches	2,612 92	1,250 89	16 59	167 75	167 75	4,215 90
King West & Mabel	2,164 16	688 89	16 45	132 15	153 50	3,155 15
King East	4,708 85	1,013 11	10 50	131 55	189 00	6,053 01
Home and Chase	1,812 18	555 24	128 52	72 45	31 00	2,599 39
§Bennett	1,009 17	356 16	12 93	53 65	15 00	1,446 91
King, B. to O	477 70	357 30	8 01	43 85	13 50	900 36
Pearl west	1,254 55	904 49	9 58	44 10	42 50	2,255 22
Market Sq. & King	535 00	348 78	10 90	45 40	39 00	979 08
Broad	485 86	291 64	12 86	45 10	32 00	867 46
St. Andrew	284 33	242 04	10 00	32 05	26 50	594 92
Apple	568 96	212 15	9 16	37 15	30 00	857 42
*Mill and John	2,355 39	1,043 08	37 67	182 60	140 35	3,759 09
*Church East	979 36	649 37	16 96	54 55	40 50	1,740 74
†Pearl East	1,212 47	329 73	18 11	79 80	48 10	1,688 11
†Jessie and Grant	136 04	178 91	6 94	57 75	21 00	400 64
‡Market North		30	4 86	14 00		19 16
‡Pine, B. to Garden			3 00	13 00		16 00
‡K'g, Mill to T'k's bl			4 50	5 00		9 50
‡King and Garden			3 60	14 50		18 10
‡Jas., Wall to Gar'n			4 00	11 50		15 50
‡Georgina			3 50			3 50
Reserve materials		2,102 67				2,102 60
	$41,940 98	$21,768 02	$1,766 58	$3,043 50	$2,296 10	$70,815 18

* Percentages unpaid.

† Not yet completed.

‡ Not yet commenced.

§ Including Storm Sewer, costing about $600.

SCHEDULE B.

Sewers Constructed as Local Improvements.

COMPLETED SEWER.	Date Petition Filed.	Date Engineer's Report.	Date First Court Revision.	Date Tenders were called.	Date Work was commenced.	Date Work was completed.	Total Length.	FRONTAGES IN FEET.			COST.			Frontage Tax.
								Assessable.	Exempt	Assumed by Corp'a'n	Total Cost.	Special Assessment.	Town's Share.	
Market	3 May, '88	16 May, '88	10 July, '88	31 July, '88	2 Aug., '88	Sept., 88	1302	1763	99⅛	752	$ 1933	$ 1355	$ 578	$0.80
Orchard	22 "	2 June, '88	10 " "	25 " "	30 July. '88	" "	1175½	2003½	71 ½	340	1847	1576	268	.80
Ormond and Pine	22 "	1 " "	10 " "	25 " "	31 " "	" "	879	1412½	150	197	1560	1270	290	.90
Bethune and bran.	29 "	4 " "	10 " "	25 " "	1 Aug., '88	Dec., 88	3277	4782	783	1194	4216	3373	843	.80
King West	22 "	19 " "	10 " "	31 " "	Aug., '88	1 July, '89	1283	2477½	.....	210	3155	2531	624	.90
Mabel	18 July, '89	2 Sept. '89	26 Oct., '89	None.	Sept., '89	1 Aug., '88	201	335	75	60				
King East	29 " '88	19 June, '88	10 July, '88	31 July, '88	Sept., '88	21 Aug., '89	2562	4511	300	332	6053	4060	1993	.90
Bennett	30 June, '89	1 April, '89	2 May, '89	20 May, '89	17 July, '89	24 Oct., '89	381	558	145	80	1446	502	994	.90
Home and Chase	29 "	5 Nov., '88	2 " "	20 " "	6 June	26 " "	819	1449	.....	187	2600	1304	1296	.90
Pearl West	27 Aug., '89	1 April, '89	2 " "	20 " "	19 "	15 July ,,	1715	3262	.....	206	2255	2121	134	.65
King, B. to O	21 Sept. '89	5 Nov., '88	2 " "	20 " "	3 "	24 " ,,	517	660	300	160	900	594	306	.90
Market Sqr.& King	6 May, '89	9 May, '89	29 May, '89	15 July	20 Aug.	13 Sept. ,,	700	683	.....	480	979	575	404	.85
Broad	None.	9 " "	29 " "	15 "	14 "	4 " ,,	532	1093	25	53	865	825	40	.75
St. Andrew	"	9 " "	29 " "	15 "	9 "	13 " ,,	453	800	.....	30	595	573	22	.75
Apple	"	9 " "	29 " "	15 "	27 "	19 Oct. ,,	447	771½	28	90	857	695	162	.90
Mill and John	3 June, '89	7 June, '89	24 June, '89	15. "	29 July	23 Dec. ,,	1656	2379	314	657	4256	2141	2115	.90
Church East	3 " "	27 " "	19 July, '89	15 "	11 Sept.	21 Oct. ,,	1357	2236	143	258	1800	1614	186	.75
											$35317	$25112	$10205	

Sewers under Construction.

Pearl East	3 June, '89	7 June	24 June	15 July	1 Aug.		3153	6768	577	2252	7000	6091	905	
Jessie and Grant	7 Oct., '89	7 Oct.	26 Oct.	None	14 Nov.		397	614	98	146	650	525	125	
										Approximate Total	7650	6616	1034	

Sewers Proposed.

Mkt., Jas. to Pearl.	3 June, '89	27 June	19 July				408	536	150	132	660	530	130	
King—Mill to Tompkin's Block	16 Sept., '89	23 Sept.	26 Oct.	Not yet	Not Com-		465	739	105	79	740	665	75	
Pine—Bethune to Garden	23 " "	7 Oct.	26 "	Called.	menced.		260	406	114	40	400	365	35	
King and Garden	23 " "	7 Oct.	26 "				600	853½	260¼	172	900	749	151	
Jas. Wall & Garden	26 " "	7 Oct.	26 "				530	681	311	140	900	613	287	
Georgina	7 " "	7 Oct.	26 "				500	849	150	66	900	764	136	
										Estimated Total	4500	3686	814	
										Grand Total	$47467	$35414	$12053	

SCHEDULE C.

SEWERS COMPLETED.	Diameter inches.	Length feet.	Rock Excavated. c. yds.	CONTRACTOR FOR LABOR.	REMARKS.
Main Outfall.....	16		4	J. F. Ward.	923 feet long in river.
Main, sec. 1.....	18	1620	674	Wood & Logan, Harry Welch.	
" " 2.....	18	1380	74¾	Harry Welch.	
" " 3.....	18 15	808 1271	316¼	Harry Welch.	
Thomas and Ann.	9	1115	531	Wood & Logan, Wm. Donovan.	Also 139 feet iron outlet.
Market.....	9	1302	1½	Armour & Cunningham.	
Orchard.....	9	1175½	5	S. A. Wiltsie.	
Ormond and Pine.	9	879	53	M. Bradley.	
Bethune & brans..	9	3277	25	T. J. P. Doddridge	
King W. & Mabel	9	1484	239½	J. D. Swartwont.	
King East..	9	2562	488	Armour & Cunningham.	
Home and Chase.	9	819	227½	Harry Welch.	
Bennett.....	9	381	103	" "	
King, B. to O....	9	517	.....	" "	
Pearl West	9	1715	1¼	" "	
Market Square & King.....	9	700	¾	Armour & Cunningham.	
Broad.....	9	532	2¼	" "	
St. Andrew.....	9	453	10	" "	
Apple.....	9	447	78¼	" "	
Mill and John....	12	1656	292¾	" "	
Church East.....	9	1357	33	" "	
Pearl East.....	9	534	225	" "	
Jessie and Grant..	9	397	68¾	Harry Welch.	
East Avenue.....	15	400	.....	Private.	Before 1887.
Park	6	200	.....	"	" "
Court House Ave.	9	125	.....	"	" "
King West from C. Avenue.....		132	.....		

Storm Sewers.

Broad.....	12	367	5	McGuire & Jackson.	
Bennett.....	12	361	100	Harry Welch.	
King St. East....	18 15	706 628	5¼	" "	
		29300	3564¾		

SCHEDULE D.

Estimate of the amount required to pay the balance due on sewers now completed and to pay for the construction of those that are now under construction, and those that are to be built next year.

	Percentages unpaid	Amt. required to complete	Total.	
Main Sewer, section 3	$ 160	$ 15	$ 175	
Mill and John	471	29	500	
Church, east	23	27	50	
Pearl, east	250	5025	5275	
Jessie and Grant	34	566	600	
				$6,600
Market, James to Pearl		Estimated Cost,	$660	
King, Mill to Tompkins' Block		" "	740	
Pine, Bethune to Garden		" "	400	
King and Garden (to Pine)		" "	900	
James, Wall to Garden		" "	900	
Georgina		" "	900	
				$4,500
Main Sewer, section 4, Kingston Bridge to Pearl St. West				$5,700
General			$1000	
Plumbing			360	
Maintenance			400	
				$1,800
				$18,600
Deduct value of Reserve Materials in stock				2,100
Total amount required				$16,500

SCHEDULE E.

Reserve Materials in stock in yard on James Street.

SCOTCH AND ST. JOHN.

75 feet of 18 inch Sewer Pipe, (Scotch).
720 " 15 " " "
180 " 12 " " "
2175 " 9 " " (St. John and Scotch)
321 " 9 " " (first class St. John and Scotch)
52 " 6 " " (seconds, " "
4 " 4 " " (Scotch)
1 Junction. 18 inch ; 5 Junctions, 15 inch ; 26 Junctions, 12 inch ; 131 Junctions, 9 inch
1 Bend, 12 inchs ; 3 Bends, 9 inches ; 4 Reducers, 6 in. to 4 in.

HAMILTON PIPES.

32 feet of 12 inch sewer pipe.
146 " 9 " " "
97 Junctions 9 inch.

1000 feet of Lumber, board measure.
650 lineal feet of Drain Tile, 5 inches in diameter.
2240 " " " " 4 " "
5 Cubic yards Sand (at foot of Broad Street.

MATERIALS IN MARKET BUILDING.

29 Barrels Portland Cement ; 11 Reducers, 6 inch to 4 inch ; 3 flushing syphons, (one charged to Church Street East) ; 1 Manhole Cover ; 70 lbs. Gasket ; 50 yards Cotton ; 100 lbs. Wire.

List of Tools and Apparatus belonging to the Engineer's Department.

1 Counter, and Pigeon Holes for Profiles ; 2 Map Cases ; 1 Cement Testing Machine with 6 Moulds, Cement Sifter, Guages, Trowel, etc.; 1 Weighing Scales ; 3 Lanterns ; 1 Brace and Bit ; 1 Hammer ; 2 Tape Lines ; 4 Tarpaulins ; 1 Hydrant Key ; 1 Valve Key ; 2 Manhole Cover Lifters ; 1 Copper Pill, 15¼ inches diameter ; 1 Copper Pill, 14¼ inches diam.; 1 Copper Pill, 12 inches diam. ; 1 Copper Pill, 7 inches diam. ; 300 lineal ft. ¾ inch Rope ; 150 lineal ft. 12 inch Rope ; 250 lineal ft. ⅜ inch Rope.

Additional Rules and Regulations Governing Plumbing.

Sec. 24. (*a*) Where a soil pipe passes through a cellar or basement it should be properly supported by brackets along the side walls, or by hooks or stirrups from the floor beams. When it is absolutely necessary to carry it beneath the floor of the basement or cellar it should be placed in an open trench or box, accessible at all times by the lifting of trap doors. The soil pipe should in no case be cemented or concretted over.

Carpenter Work.

(52) No woodwork shall be placed at the front or sides of a water-closet bowl, enclosing the same, without the permission of the Engineer. The seat shall be hinged in such a manner that when thrown back the bowl will be exposed on all sides.

(53) Where either vertical or horizontal pipes are enclosed, small doors must be so placed that all parts shall be accessible at all times.

(54) Traps, bends, elbows and connections should not be placed beneath floors, otherwise trap-doors (not screwed down) shall be so placed that all such traps, bends, elbows, connections, etc. can be readily examined at any time.

(55). The owner and plumber must satisfy the Board of Sewer Commissioners or their officers that these Rules and Regulations will be strictly adhered to before a permit will be granted.

Inspections.

(56) Through settlement of walls, frost, use of improper materials, or by poor workmanship it is possible that plumbing fixtures may become broken, or leaky. To protect the citizens from the dangers that might arise trom any such an occurance as well as to prevent the improper use of fixtures. an inspector will be sent to examine all fixtures at such times as the Board of Sewer Commissioners may direct.

(57) If it is impossible to properly examine all fixtures and pipes in any building, they being placed in inaccessible positions, the owner, or his agent, shall make such pipes and fixtures accessible, if inspector so directs, the same as in new work, within five days after notice has been given him to do so, and he shall so leave them that they can be examined at any time thereafter, without the use of any tool whatsoever.

(58) If water-closets, water-closet compartments, urinals, slop sinks, or other fixtures are found in a filthy or unclean condition, the tenant or owner will be notified of the fact, and if again found in an unsanitary condition the tenant or owner shall be proceeded against for creating a nuisance.

WILLIS CHIPMAN, C. E.

Brockville, 1st February, 1890.